Tait Environmental Management, Inc.
ENGINEERING • ENVIRONMENTAL • COMPLIANCE

Technical Memorandum

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To: Mr. Robert P. Scott (Via: E-mail)
Boeing Realty Corporation
4501 East Conant Street, M/C D851-0097
Long Beach, CA 90808

cc:

Mr. John R. Scott, PE	The Boeing Company	(Via: E-mail)
Mr. Dennis Carlson	The Boeing Company	(Via: E-mail)
Mr. Joseph Weidmann	Haley & Aldrich, Inc.	(Via: E-mail)

From:
Narcisa M. Boeru
Project Manager

Mr. Ravi Subramanian
Principal and Project Manager
Camp Dresser & McKee Inc.

Subject: Groundwater Monitoring Program Lessons Learned 2006
Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California

Tait Environmental Management, Inc. (TAIT) has prepared this memorandum to identify and discuss the 2006 Lessons Learned during the Groundwater Monitoring Program at the Boeing Realty Corporation (BRC) Former C-6 Facility in Los Angeles, California (the Site) (Figure 1).

BACKGROUND

The Site is located at the northeast corner of Normandie Avenue and Knox Street in Los Angeles, California. Two groundwater plumes have been identified at the Former C-6 Facility (former Building 2 and 1/36) (Figure 1). The Building 2 primary volatile organic compounds (VOCs) include trichloroethene (TCE), 1,1-dichlroethene (1,1-DCE), and chloroform. The Building 1/36 primary VOCs include TCE, 1,1-DCE, methyl ethyl ketone (MEK or 2-butanone), toluene, and 1,1,1-trichloroethane (1,1,1-TCA). A network of injection wells have been installed to treat TCE concentrations in excess of 5 milligrams per liter (mg/L) in groundwater beneath the source areas and General and Individual Waste Discharge Requirements (General and Individual WDR) exist at the Site. The Groundwater Monitoring Program includes WDR and Quarterly Groundwater sampling for select wells at the Site.

This technical memorandum was prepared to provide information specific to the Groundwater Monitoring Program and provide a basis for continuing to implement solutions to improve the overall success of the Former C-6 Facility Groundwater Monitoring Program.

OBJECTIVES

The objectives of the Lessons Learned process are to:

- Identify the project practices that are beneficial, as well as those areas that need improvement.
- Incorporate input from the project team to improve project planning, execution and management process for the Groundwater Monitoring Program.
- Develop specific recommendations for overall improvement of the groundwater monitoring program

LESSONS LEARNED FINDINGS FOR THE GROUNDWATER MONITORING PROGRAM

Input from the Former C-6 Facility groundwater monitoring team members, including the Project Data Manager (CH2M Hill) and the analytical laboratory (Test America or TMA) was obtained for all facets of the project including sampling/technical strategy, project management, field implementation, sample management, laboratory analysis, and data uploading and management. The findings for both plus and delta factors are discussed below.

"Plus" Factors

"Plus" factors were identified as items that were positive for the program in terms of cost or schedule efficiency. Plus factors identified by team members are described below. While they were not formally scored or ranked, the team members considered the following Plus factors to be very important to the project's success:

- Internal groundwater sampling plans are prepared for each monitoring event. The sampling plans list the wells to be gauged and sampled and provide a summary of sampling methods, sampling order, field parameter monitoring requirements, analytical requirements, and quality assurance sampling requirements.
- Equipment calibration records were developed and implemented before and during each groundwater sampling event at the Former C-6 Facility to document any problems that needed to be addressed between sampling events.
- Equipment maintenance records were implemented to reduce downtime during groundwater sampling.
- Groundwater sampling time at each well location was reduced by approximately 20% after dedicated tubing was implemented at each sampling well in the program.
- The implementation of low-flow purging techniques decreased the amount of water accumulated for disposal and thus created a savings for the overall project budget.
- Pre-field checklist and Laboratory Task Order (LTO) address any potential changes prior to site mobilization saving time and cost to the project.

- A gauging spreadsheet is prepared before each sampling event to prevent the omission of any wells during water level gauging events.

- Early pre-field reconnaissance of the site conditions helped identify changes and or impacts that directly affect the implementation and completion of one or more of the sampling events. A prime example has been the Building 2 area where over the last year construction has impacted access to well locations.

"Delta" Factors

"Delta" factors where identified by the team members as needing improvement or potential elimination. Delta factors and associated suggested solutions are identified and briefly described below. While they were not formally scored or ranked, the team members considered the following Delta factors to be most significant contributors to the program's inefficiencies:

- At wells scheduled for quarterly sampling only, insufficient purge volumes (less than 3 wetted casing volumes) were removed prior to sample collection. The sampling protocol in the 2007 Annual Groundwater Monitoring Workplan (Annual Workplan) calls for purging of 3 to 5 wetted casing volumes prior to sample collection.

  Suggested Solution: The field staff will have to pay closer attention to groundwater sampling protocols and use the entire wetted casing and screen volume in purge water calculations.

- Groundwater samples were collected prior to stabilization of field parameters (conductivity, dissolved oxygen (DO), turbidity, and or pH). The individual plans and the Annual Workplan call for stabilization of field parameters such that the last three readings are within +/-3% for conductivity, +/-10% for DO and turbidity, and +/- 0.1 for pH.

  Suggested Solution: If parameters do not stabilize, purging should continue for up to 5 wetted casing volumes per the Annual Workplan.

- Low-flow sampling methods were not used at some of the wells that were scheduled for low-flow sampling as mentioned in the individual sampling plans.

  Suggested Solution: The field staff will have to pay closer attention to the sampling plan in selecting the purging and sampling method for each well. In addition, it is recommended adding a column/space on the gauging sheet as to which wells need to be sampled using low flow methods.

- Drawdown exceeded 0.3 feet during low-flow purging of some of the well.

  Suggested Solution: Since low-flow purging can achieve flowrates from 10 milliliters (mL)/ minute to 500 mL/minute, sampling team will have to pay close attention to wells that have a slow recharge rate and document these wells and their recharge rates for future events.

- Groundwater sampling data sheets indicated low-flow sampling flow rates of 0.3 to 0.5 gallons per minute (gpm), compared to the required flow rate of less than 0.5 liters per minute (lpm). While some of these values were incorrect, other values appeared to have just incorrect units (gpm instead of lpm) indicating recording errors..

  Suggested Solution: The field sampling team will have to pay closer attention to recording purging flow rates on the groundwater sampling data sheets. In addition, it is recommended to have separate field sampling data sheet template for the low flow wells containing the appropriate units for flow rates (i.e. liters per minute) and other pertinent information.

- Additional analyses beyond what is specified in the sampling plans has been performed on field duplicate samples and field blanks have been collected when not required by the sampling plans

  Suggested Solution: The field sampling team will have to pay closer attention to the analytical schedule provided in the individual sampling plan.

- Anomalous and inconsistent DO and ORP measurements have been noted in several wells and has been a continuing issue in several of the sampling events. For example in June 2007 at TMW-07, the DO was measured as 11.37 mg/L, which is too high for natural site conditions. At AW0073C, the DO was measured at 0.00 mg/L and the corresponding ORP value was +275 mV, which is far too high an ORP value for water with no dissolved oxygen. The anomalous measurements may be due to air introduced into the flow through cell and/or instrument calibration errors.

  Suggested Solutions: While field measurement of these two parameters is known to be difficult, certain steps can be taken to minimize the possibility of these errors (Note: some of the steps have already been implemented):

  - Field staff should check flow through cell setup for problems as mentioned above.

  - To confirm that the DO probe is functioning properly, a 2 point DO calibration, using a zero DO solution and a max DO solution (8.53 mg/L), have been implemented for the instrument on a daily basis and will be performed daily during each sampling event.

  - To confirm that the ORP probe is working properly, a calibration check with an 89 mV standard solution has also been implemented and will be performed daily during each sampling event. Calibration with an additional standard solution (such as the ZoBell's solution which is the standard solution for testing redox instruments) should also be performed.

  - When suspect DO/ORP readings are noted at any time during the sampling event, calibration of the DO probes and ORP probes will be checked as described above, especially checking the low end of the DO scale with Zero DO solution.

  - All calibration protocols shall be documented in field paperwork and Field Data Reports (FDRs)

- If anomalous and/or inconsistent readings still exist after two events, then CDM recommends switching to YSI meters. Based on CDM's experience, the YSI 5500 and 6000 series water quality meter have provided better DO and ORP data than the Horiba U22 and U10 meters, even when the YSI meters were only calibrated on a one point high end calibration with air.

- PID readings not measured during groundwater sampling event as required per the Annual Workplan.

  Suggested Solution: Ensure that a PID is made available for the sampling technician for the entire duration of each sampling event. In addition, it is recommended adding a column/space on the field forms for the PID readings. All field forms shall be checked the next day to verify (among other things) that PID readings have been measured.

- On occasions, water levels in offsite wells XMW-09 and XMW-19 were not able to be gauged during the same time as the other wells, due to access issues.

  Suggested Solution: Advance coordination and communication should be made with Earth Tech, so that the key to these well locks are obtained well in advance to the water level gauging event. Issues like this need to be identified in the pre-field checklist which must be submitted at least two weeks in advance of the sampling event.

- The condition of each well has been noted on the gauging form in the past to document the condition of a monitoring well. However, there is not a process in place to check if any issues with the wells have been resolved.

  Suggested Solution: In the future, prior to each monitoring event, the gauging form from the prior monitoring event should be reviewed and any issue with a well should be completed during that event and the activities documented. Wells requiring additional work should also be identified in the pre-field checklist.

- Frequency of required maintenance on sampling equipment is increasing as the equipment ages.

  Suggested Solution: Dedicated sampling pumps for this project are currently being evaluated so that rental of the equipment can be eliminated. Such pumps if used shall not be used on other sites.

- Dedicated tubing caused an obstruction in well MWG002.

  Suggested Solution: Tubing is now being secured to the well cap on all the wells to prevent tubing from falling or being pushed down the well and causing an obstruction.

- Instrument error resulting in field downtime.

  Suggested Solution: Instruments are inspected and tested prior to each sampling event to ensure minimal downtime during an event. There should also be a plan to review data in the field so that

if inconsistent readings from a certain instrument are being recorded, it can be rectified prior to the end of the sampling event.

- Changes to sampling plans were not distributed to the field crew, causing additional, inaccurate, or incomplete analyses.

  Suggested Solution: Communicate with project team on correct sampling plan revisions that are to be implemented in the field. In addition and more importantly, the final sampling plan should be distributed at least two weeks prior to the start of field work. A meeting/conference call with the field personnel and the appropriate laboratory personnel shall also be conducted at least one week before start of field work to discuss the sampling plan.

- Switching or adding a new subcontract laboratory without ample time prior to a groundwater sampling event causes delays as different labs may have different bottle requirements and protocols. Ample amount of time is needed to process the new information by the project team.

  Suggested Solution: Communicate with project team any changes in the subcontract laboratory well in advance of the event, preferably when sampling plan is distributed.

- Lab generated sample log is not being referenced with what is sent to Boeing Electronic Data Management System (BEDMS). There have been frequent occasions where the laboratory has had to make revisions to reports and Electronic Data Deliverables (EDD), even after the sample logs have been uploaded to the BEDMS in a timely manner. The point of these sample logs is to verify that all well ID's are logged in accurately as are date and time of sample collection. It is a burden on the laboratory to have these items discovered after the report and EDD has been issued to the BEDMS. The sample logs are typically generated between 24-36 hours after the samples have been received by the lab, and the reports are usually due 2 weeks after sample collection. This should be more than ample time to discover a discrepancy, and there should be no need to revise a report because of a sample ID issue

  Suggested Solution: All chain-of-custodies (COCs) shall be checked to ensure accuracy of sample names, selected analytical methods, etc and any corrections submitted within 24 hours of submittal to the laboratory.

- More complete information must be given on the LTO. Even with an LTO, questions need to be asked as to what exactly the consultant needs for sampling.

  Suggested Solution: Communicate with the laboratory prior to completing the LTO, at least two weeks prior to the sampling event.

- Pre-selecting samples for validation before sample comes in to the laboratory. While this may not be a lesson learned, it may need to be filed as lessons to be learned. The way the laboratory's data package system works, the data package test codes must be logged in while the samples are received. If validation is requested after the samples have been received, it is much harder for the laboratory to pull the necessary data files after the fact. Pre-selecting samples needed for validation will result in a much more timely delivery of the data packages to the data validation consultant.

- Data missing from the Boeing Portal.

  Suggested Solution: Missing data is addressed on a weekly basis after replication takes place on the Boeing Portal each Tuesday night. This should be documented in some fashion to verify completion.

- 26 of 29 EDDs were provided late to the BEDMS (an average of nearly two weeks late).15 of 29 EDDs provided were returned due to errors. After being returned to the laboratory, it took the laboratory an average of two weeks to submit a correct EDD. Reasons for resubmittal included: EDDs not being submitted in the correct project format; EDDs missing analyses or analytes, including additional analysis runs that should not have been included in the EDD; and sample naming changes.

  Suggested Solutions:

  - The Project Data Manager has instituted a more rigorous pursuit of outstanding data. Each Friday, the Project Data Manager emails to the laboratory and the consultant a list of outstanding EDDs (both those never submitted and those that have been submitted and rejected). Being proactive regarding the receipt of EDDs has reduced the deliverable time.

  - Consultant should be more proactive with the laboratory for both quality and timeliness of the deliverables. When a consultant is involved in quality and timeliness issues, laboratories have historically been more diligent.

  - Sample naming issues, where a sample name change is requested by the consultant after the laboratory data has been delivered to BEDMS (the laboratory correctly used the sample names provided on the COC, but the consultant later decided to change those sample names), being the cause for late EDD delivery should be greatly reduced through implementation of the following steps:

    - Sample names should be planned in advance to reduce the amount of manual work required of the sampling team in the field, thus reducing transcription errors. In most cases the sample names can be generated prior to samplers entering the field and sample labels, including the requested analyses, and COCs can also be created prior to leaving for the field. In instances where the exact date of sample is not known in advance, a blank can be left on sample labels and entered by the sampling team when the sample is collected. That sample can then be added to the correct pre-prepared COC. In the worst case scenario, if the uncertainty of sample dates is such that no COCs can be prepared in advance, the sample team still has sample labels with the pre-approved sample names, minus the date portion, and the requested analyses to use as a reference when completing the COC.

    - The consultant should review all COCs within 24 hours of submittal to the lab to ensure accuracy of sample names, selected analytical methods, turn-around times (TATs), etc.

- The consultant must submit the sample log within the project-required TAT (3 days according to the Data Management Plan), to the Project Data Manager. If this occurs, the Project Data Manager will check the receipt from the laboratory against the sample log and will be able to catch any naming issues prior to the lab generating any further deliverables.

- Only one sample log was received within the project-required 3-day TAT (The TAT is calculated based on the date of the receipt of a correct sample log). The average submittal was over two weeks late. In addition, issues were noted with sample logs which consisted of: sample names not matching the chain-of-custody forms; method names not matching the EDD; and valid value lookups not being followed.

  Suggested Solutions:

  - The sample logs should be added to the list of tasks accomplished prior to entering the field. Only minor additions/modifications would need to be made after sampling to complete the sampling log. This would make it much easier to submit timely and accurate sample logs. If sample logs are submitted in a timely fashion, sample name issues can be caught prior to the changes impacting lab data deliverables.

  - If the consultant wishes to use lookups not currently in the valid value list, the Project Data Manager must be contacted. Where possible, lookup issues should be resolved prior to entering the field and always prior to submittal of a file containing a lookup not included in the valid value list.

- EDD from one of the subcontract laboratories was not submitted in the appropriate format for the portal resulting in delayed submittals and resubmittals.

  Suggested Solution: Prime laboratory should communicate well in advance with the subcontract laboratory of the portal requirements. The consultant (s) should also confirm with the prime and the subcontract laboratory that the portal requirements have been communicated and understood by the parties involved.

DISCUSSION

The most important lesson learned was communication is key to implementation of the groundwater sampling program at the Site. Allowing enough time for the team to process any new information prior to mobilizing in the field is the next most important lesson learned. Each of the "Delta" factors mentioned above will be reviewed at a project team meeting (date to be determined) so that items that need improvement can be discussed in a positive and constructive atmosphere.

The Lessons Learned process is an important part of the Groundwater Monitoring Sampling Program and benefits the overall environmental program component of the remediation efforts at the Site, and it should therefore be revisited on a regular basis.